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Putting carbon markets into practice: a case study of financial accounting in Europe

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Abstract

The paper explores how carbon markets have entered the world of financial accounting. The advent of the European Union Emissions Trading System (EU ETS) in 2005 provided the opportunity for global climate change concerns to be translated from policy into something that could, and should, be recognized within financial accounting. That is, the EU ETS provided a mechanism whereby greenhouse gas emission allowances acquired a financial value, simultaneously creating an obligation (or liability) on certain European organisations when they emit greenhouse gases. Prima facie, this process created the need for financial accounts of companies covered by the EU ETS to reflect the new commodity of carbon. Disagreement amongst accountants about how to treat emission allowances has arisen, with the initial international accounting guidance issued in late 2004 subsequently being withdrawn, and not yet replaced. Taking this absence of guidance as a starting point, the paper undertakes an empirical project (through a survey, consultation analysis, and interviews) to establish what financial reporting practices are being adopted by participants in the EU ETS, and the level of momentum for standardisation. The paper draws on sociological theories about accounting, measurement and markets.

Keywords

Carbon markets; financial accounting; European Union Emissions Trading Scheme (EU ETS); standard setting; emission allowances

Introduction

A central element of society's response to climate change has been the construction of markets in which standard units of greenhouse gas emissions (referred to here as 'emission allowances'¹) are created and exchanged (Bailey and Wilson, 2009; Boyd et al., 2011; Bridge, 2010; Callon, 2008). The largest global carbon market that has been created, to date, is the European Union Emissions Trading System (EU ETS): it comprised 84% of global carbon market value² in 2010 and is worth US\$120 billion (Linacre et al., 2011). How well carbon markets work depends upon the information provided to the market, and financial accounting and reporting by companies is one such source of information (and one which is crucial for accurate valuation of companies by investors and others). In this paper we provide an empirical examination of particular financial reporting practices of large corporate greenhouse gas emitters within the EU ETS, based on a survey of corporate financial accounting disclosures and follow-up telephone interviews with accountants (#5). In addition, we examine the views about emission allowances provided by respondents (#248) to an Agenda Consultation exercise conducted by the International Accounting Standards Board (IASB) in late 2011.

The aims of the paper are both policy-based and conceptual. The paper addresses three core questions: 1) What financial accounting and reporting practices for emission allowances are being used in Europe, and why?; 2) Is the extent of non-disclosure a problem?; and 3) How do sociological theories about accounting, measurement and markets help us understand the situation, and provide ideas for action?

¹ In the EU ETS emission allowances are called 'European Emission Allowances', shortened to 'EUAs'. For simplicity in this paper we use the term 'emission allowance' throughout, rather than the more general term 'carbon credit' (which encompasses carbon offsets as well as greenhouse gas reductions).

² Global carbon market value is defined by the total quantity and value of allowances traded worldwide, with exchange rates normalised. The remaining 16% of the global carbon market comprises primary and secondary Clean Development Mechanism credits, plus a mix of other voluntary carbon offsets (see Linacre et al., 2011: 9).

In relation to policy it has been argued that there is a need to standardise accounting in this area to ensure the availability of comparable information about participant companies (McGready, 2008; The Aldersgate Group, 2007). In particular, since the withdrawal of international accounting guidance in 2005 there has been no formal accounting recommendation as to how to account for EU ETS obligations, and a diversity of practices and types of disclosure have been followed by companies (as found in Lovell et al., 2010; and other studies, see PricewaterhouseCoopers and International Emissions Trading Association, 2007), making comparison between companies difficult. There is an opportunity to conduct empirical research in this area because of the continuing (and likely future) uncertainty about how to measure allowances (that is, what value to assign to them and the obligations that arise in the context of the EU ETS) and account for them (that is, what disclosures should be made in accounts). Second, from 2013 onwards, European greenhouse gas emitters will be required to purchase emission allowances at auction; auctioning being the default method of allocation. It is expected that at least half of emission allowances will be auctioned from 2013, leaving free allocation for those sectors that are exposed to more risk of carbon leakage. This shift to purchasing allowances will have knock-on effects for carbon financial accounting, effectively meaning emission allowances will no longer be able to be ‘hidden’ in the accounts of many corporations. At the time of writing these accounting policy issues have yet to be resolved, a point that will be further developed in conclusion.

Alongside these policy concerns there is a growing theoretical interest in better understanding the implications of the creation of a new carbon commodity, and the associated development of new carbon market standards and practices (Boyd et al., 2011; Bumpus and Liverman, 2008; Lovell et al., 2009). To date, however, the financial accounting issues associated with

carbon markets have been relatively neglected (for exceptions see Ascui and Lovell, 2011; Bebbington and Larrinaga-Gonzalez, 2008; Lovell and MacKenzie, 2011; MacKenzie, 2009a), and this paper seeks to rectify that balance. Accounting for carbon credits is in its formative stages, that is, rules and practices are still ‘hot’ or unsettled (Lohmann 2009) and as such this setting provides an opportunity to explore the process by which new accounting principles and practices come into being. Financial accounting is known to be an area of professional activity with intense regulatory activity, and yet the case of carbon financial accounting reveals an absence of rules, despite attempts to develop them. Through a mix of empirical discussion and theoretical interrogation we seek to explore why this has been the case.

Understanding carbon financial accounting

Before examining our empirical findings we consider how best to conceptualise carbon financial accounting, a topic which potentially cuts across a number of different theories and bodies of research. Three areas of literature (theories of accounting and society, theories of measurement, and economic sociology (so-called ‘hybrid’) approaches to markets) are used as lenses to explore the challenges of governing the financial reporting of carbon, and the relationship between accounting and society more broadly. The review undertaken here is necessarily brief: it is not the authors’ intention to provide a full summary of these sizeable literatures, but rather to consider how this material might provide insight into accounting for emission allowances in the EU ETS.

The relationship between accounting and society

For many years accounting scholars have argued that accountancy is not “a mere collection of techniques for the assessment of individual economic magnitudes, but (...) an activity that at

the organizational level can shape ‘participants’ views of what is important (...) to create a particular conception of organizational reality.” (Burchell et al., 1980: 5). In short, accounting plays a constitutive role in social processes (Hopwood and Miller, 1994) and should not be studied "as an organizational practice in isolation from the wider social and institutional context in which it operate[s]" Miller (1994: 9). Accounting is both shaped by the social, cultural and political environment in which it operates, *and* gives rise to social processes, and thus is perceived as an instrument for social management and change (Burchell et al., 1985). Indeed, "accounting is, above all, an attempt to intervene, to act upon individuals, entities and processes to transform them and to achieve specific ends " Miller (1994: 1). In the context of this paper, therefore, the accounting treatment chosen by companies constructs the significance of carbon markets, and provide insights into the relative importance of carbon in communications to stakeholders via an organisation’s financial accounts.

An accounting and society theoretical perspective cautions against seeing accountancy as a relatively boring and routine site for studying how markets have come into being. As a result, we are interested in how the accountancy profession is responding to increasing societal concerns about climate change and the role that accountants are playing in shaping and influencing how climate change is made sense of and dealt with (for examples of work on this theme see Bebbington and Barter, 2011; Bebbington and Larrinaga-Gonzalez, 2008; Cook, 2009; Lohmann, 2009; Lovell and MacKenzie, 2011). Using this perspective, accountancy scholars have drawn attention to the often subtle ways that power is expressed in decisions about detailed, technical accountancy rules (Miller, 1994; Miller and O’Leary, 1994; Thompson, 1994). With carbon accountancy still in its formative stages (and with many critical decisions to be made) close attention to all governance processes and decision

making, including accounting treatments, will yield theoretical and policy insights. Moreover, because carbon accountancy rules (once decided) will potentially have a material influence on company financial reports (namely, profit measures, assets and liabilities; as our empirical analysis below reveals) it is likely to be a site of conflict. Far from being rule-based and standardised – a ‘neutral device’ – carbon financial accounting is at present highly uncertain.

Moreover, if a lack of guidance regarding accounting treatment persists, the question of why we do not see regulation in this area becomes a pertinent one (this is returned to in our analysis of the IASB Agenda Consultation). Indeed, one might argue that ignoring an issue, if it is contested and significant, creates one way to ‘resolve’ this tension.

Whilst the literature on accounting and society is directed, of course, to a particular area of endeavour – accounting – in an era in which many elements of government increasingly involve measuring, standardising, auditing and, in its broadest sense, accounting, the insights of this literature have wider application. There are notable parallels, for example, with the concept of governmentality (Dean, 1999; Foucault, 1991), especially in the notion of technologies and practices themselves influencing policy (Gouldson and Bebbington, 2007; Power, 1999; Spence and Rinaldi, 2012). But there are some aspects of the case of carbon financial accounting in Europe that the accounting and society literature fails to illuminate, simply because to date accountants have not been the key actors in making carbon ‘visible’ within the EU ETS. Indeed, as we demonstrate below, it is quite the opposite, as the net effect of financial accounting has been to obscure the passage of emission allowances in and out of corporate balance sheets. So, whilst the EU ETS as a whole has been about making pollution visible, thus far it is other market actors – the European Commission, financial exchanges, and so on – who have done this work. For this reason it makes sense to broaden our gaze to

theories less centred on accounting per se; theories which consider measurement, standards and markets.

Theories of measurement and standards

There is a broad political science and science and technology studies literature about classification, commensuration and standard-setting, on topics as diverse as medicine and atmospheric science (Alonso and Starr, 1984; Bowker and Star, 2000; Espeland and Stevens, 1998; Timmermans and Epstein, 2010). This literature provides an analysis of how diverse phenomena are made the same, examining the role that classifications and standards play, who does that work, and what happens to cases that do not fit into standard categories that have been constructed by society. The insights provided by these conceptual questions have clear relevance to accounting, and indeed have been used to explain and understand aspects of financial accounting (MacKenzie, 2006; Robson, 1992).

A central theme of the literature is about the invisibility of the multitude of standards that allow the modern world to function, with research demonstrating that once a standard comes into being it quickly becomes taken for granted, and then given little attention (Bowker and Star, 2000; Busch, 2000; Timmermans and Epstein, 2010). As Timmermans and Epstein state "[s]tandards and standardization are such widespread and omnipresent features of modernity that, ironically, their precise sociological significance stands at risk of vanishing out of sight." (2010: 84). Bowker and Leigh Star (2000) in their analysis of health service and race classifications similarly demonstrate how systems of measurement are typically paid little attention on a day-to-day basis: "Good, useable systems disappear almost by definition. The easier they are to use, the harder they are to see. As well, most of the time, the bigger they are, the harder they are to see." (2000: 33). Financial accounting is one such pervasive 'big

system' (a 'metadevice' to use the language of MacKenzie, 2009b), and it provides an interesting case through which to examine the distinctiveness of climate change as a problem. For, as noted (and as our empirical research demonstrates), there is nothing yet habitual about carbon accounting practices, and carbon accounting therefore stands in stark contrast to much of the rest of accounting, which is relatively ingrained, 'black-boxed' and routine (MacKenzie, 2006).

One important role of international standards, such as those in financial accounting, is in providing a stable calculative frame, defined as "the cognitive and material infrastructure that underlies economic calculations of value" (Callon et al., 2007: 33), thereby allowing markets to function. Ideas about calculation, popular in theories of hybrid markets (see below) and economic sociology more generally (Callon, 2007; MacKenzie, 2007), argue that far from being a rational, abstract process, calculation is in reality determined by a host of factors including politics, technologies, and types of expert knowledge. As Mitchell argues "... successful calculative devices ...are those that make it possible to conceive of a network, or market, or national economy, or whatever is being designed, and assist in the practical work of bringing it into being." (Mitchell, 2008: 1118). Financial accounting is clearly a relevant site of calculation for the European carbon market, but, as we discuss below, it is a site where the accounting profession itself appears to be keen not to take centre-stage.

A further insight from this literature that is particularly relevant for the study of carbon accounting is analysis of so-called 'incommensurables'. Bowker and Star (2000) advocate concentrating critical analysis on incommensurable cases that do not fit in because they highlight unresolved tensions. Emission allowances do not fit neatly under any existing accounting standard, and are hence hard to classify, making them a type of incommensurable.

The difficulties presented in accounting for emission allowances have their origins in the multiple potential uses of emission allowances: as a commodity, a currency, a financial instrument and so on (Bank of England, 2009). As Espeland and Stevens (1998: 316) explain "commensuration is noticed most when it creates relations among things that seem fundamentally different". MacKenzie (2009a) makes precisely this point with regard to carbon accounting, outlining how markets in rights to emit greenhouse gases can only exist if a variety of different things are convincingly 'made the same'. He uses the example of how the Clean Development Mechanism (part of the UNFCCC Kyoto Protocol) allows the destruction of one tonne of an industrial waste gas, trifluoromethane, or HFC-23, in a facility in China to be converted into rights to emit up to 11,700 tonnes of carbon dioxide in a power or heat generation plant in Europe (MacKenzie, 2009a). MacKenzie (2009a) and Cook (2009) consider how the problems accountants face with regard to emission allowances are complex not only in terms of measurement, but also with regard to classification and type of recognition. The assumptions used to create equivalence in carbon financial accounting can be challenged on a number of levels, and where we can usefully add to existing scholarship on carbon accounting is in showing how these tensions have played out in practice in the financial accounting of carbon within the EU ETS.

Theorising hybrid markets

Another set of ideas that is relevant for our investigation is about how economic and financial markets are created and how they are constituted. An interdisciplinary approach to the study of markets asserts that markets are not just economic or financial entities but comprise a mix of people, technology, objects and things. This conception of a market draws from economic sociology (Barry, 2005; Callon, 1998; Fligstein, 1996; Hardie and Mackenzie, 2007; MacKenzie, 2008; Pryke, 2007; White, 1981), and is concerned with how economic markets

are separated out of everyday relations and made into a recognisable, working mechanism of exchange (Callon, 1998; Munro and Smith, 2008). In this context, examining the micro-structures of markets for carbon focuses attention on the intricate networks of people and ‘things’ that constitute the carbon economy, thereby explaining why abstract models rarely fit the specifics of particular times and places. Economic sociology approaches recognise the myriad tensions and the hard work that goes into sustaining carbon markets such as the EU ETS every minute of every day. These approaches also recognise that markets have to be made: Pryke (2007), for example, assesses the emergence of weather-based financial trading instruments since the late 1990s, using a cultural economy approach to finance; likewise, Hardie and MacKenzie (2007) examine the workings of hedge funds, showing how the market is constructed and shaped by a mix of people and technologies.

Whilst it might sound self-evident that a mix of people, objects and technologies (what Callon terms ‘*agencements*’) determine what a market is and how it evolves, such a framing serves as a useful counter to arguments (found in carbon markets and beyond) that ‘the market’ itself has agency, or in Callon’s (2008: 539) own terms, that markets are ‘quasi-natural realities’. A hybrid market approach aims to demonstrate how markets are no more or less than the complex network made up of various elements that comprise them. Of particular interest in the context of this paper are the technical accounting rules and procedures that are essential to carbon market operation. As noted, these accounting rules and procedures have thus far remained outside of the typical frame of reference of many key actors in the carbon market. This may in part be explained by the power of technical rules and practices to make things appear ‘anti-political’ (after Barry, 2005), suggesting that the lack of attention in mainstream carbon market policy debate to issues of financial accounting does not indicate an absence of tricky issues, but rather that these issues have struggled to emerge from the

close-knit and technically impenetrable world of financial accounting. There is evidence that the same applies in converse, with financial accounting standard setters struggling to make sense of the complex rules and practices of carbon markets (IASB, 2009).

Another key insight of the hybrid markets literature concerns the potential for markets to be actively shaped and governed by various actors. For a new market such as carbon (a clear example of something created, in this instance mostly by public institutions and governments) it is important to appreciate the implications of its public sector origin (Polanyi, 1944). Callon neatly explains the value of seeing markets as both governable and experimental when he suggests: "[w]hat sociology and anthropology could bring to the [markets] debate is precisely a recognition of the experimental character of markets and market organisation and the need to debate the consequences of experimentation. It is a collective learning process" (Callon, quoted in Barry and Slater, 2005: 114).

The value of these ideas about markets for carbon is in illuminating the experimental nature of a relatively recently constructed environmental market - carbon - resting on the commodification of atmospheric gases, and its consequent reliance on sound, workable systems of measurement and classification, not least financial accounting (Callon, 2008). Further, they open up the possibility for change in how carbon financial accounting is carried out, not just in terms of new formal institutional accounting standards (issued by the IASB and others) but also via 'bottom up' changes in practices, e.g. new accounting practices and ideas proposed by the accountants actually doing the day-to-day work of carbon accounting, carbon market politics, the classification of emission allowances, and so on.

A concern of Callon's regarding carbon markets is that the 'framing' of the carbon market is premature. Market actors (including policy makers and politicians) have been trying to establish boundaries and rules before really understanding the issues at stake, or truly appreciating the novelty of carbon as a commodity. As Lohmann (2009) echoes in his insightful analysis of differences between carbon and other types of commodity (in this case, wheat): "tensions can be expected to arise whenever a novel commodity is being created *that depends fundamentally on the development of new accounting procedures.*" (Lohmann, 2009: 507, emphasis added). Lohmann's work is unusual here in emphasising the integral role of accounting as the foundation of carbon markets and wider climate change mitigation activities, feeding into the argument, developed by the accounting and society literature, about the constitutive power of accounting in social processes such as market formation.

In summary, in this broad review of literature we have highlighted several ideas drawn from work in the areas of society and accounting, measurement, and economic sociology (hybrid markets) that provide insights to the case of carbon financial accounting in the EU ETS. Now, after outlining our research method, we turn to examine the key empirical findings of our research on carbon financial accounting. By way of introduction a brief history of the financial accounting aspects of the EU ETS is given. Through this necessarily partial overview it is hoped that a flavour is conveyed of the technical complexity and ambiguity of the treatment of emission allowances in financial accounting.

Method

The paper is based on findings from a 2010 desk-based survey of financial statement disclosures of 26 large corporate emitters in the EU ETS, five follow-up telephone interviews, and content analysis of the IASB 2011 Agenda Consultation responses (#248

letters). The 26 European companies surveyed constitute 25% of all EU ETS carbon emissions.³ This 25% cut-off point ensured that we included in our survey the emission allowance accounting practices' of the main polluters, for whom emissions are most likely to be material (i.e. financially significant) to their accounts. The European Commission's Community Independent Transaction Log (CITL)⁴ was used to identify 68 installations (individual factories/power stations) that matched the organisations (#26) that emitted the largest amount of carbon in the EU ETS. The companies surveyed are listed in Table 1. Data on the accounting disclosures made in the financial statements of these companies was gathered using content analysis which sought to ascertain the systems of classification, measurement and reporting followed by the companies. Specifically, we sought to identify where emission allowances are recognised on balance sheets (as inventory, tangible or intangible fixed assets and how the obligation is recognized), at what value are they recognised initially (so called *fair value* – i.e. market price - or at *cost*, i.e. nil value in the case of granted allowances), and how they are subsequently accounted for (see Lovell et al., 2010 for further detail).

Accountants from all 26 companies surveyed were invited for a short follow-up telephone interview (of 15-30 minutes duration) to explore in more detail why they adopted the accounting practices they did; from where they sought and obtained advice and information; their opinions on possible future changes to EU ETS accounting; and the role of accounting standard setters in this context. Only 5 interviews (19% of companies) were secured, with

³ Note that the EU ETS operates on an installation basis while accounts are provided on an entity (company) basis. Exact total for company carbon emission is 25.64%.

⁴ Given that the CITL only provides details of installations, and not company data, a matching of installations to companies was undertaken: 68 installations were selected from the CITL which equate to just over a quarter of the EU ETS total verified emissions in 2008. The companies owning the installations were then identified via internet searches with 26 organisations collectively owning these 68 installations.

reasons for non-participation focusing on concerns about commercial confidentiality.⁵ The interviews that were conducted were digitally recorded (with the interviewee's permission) and transcribed. Coding of transcripts was undertaken using the qualitative software package 'Atlas', using an inductive approach to coding.

EU ETS Sector	Name(s) of companies surveyed
Combustion	British Energy, Skupina ČEZ České Energetické Závody (CEZ), Drax, East Energia, EDF Energy, Energias de Portugal (EDP), Edson, Endesa, Ente Nazionale per l'energia Elettrica (ENEL), E.ON, Essent, Grosskraftwerk, Iberdrola, Nuon, PPC Energy Group, PGE, RWE
Iron and Steel	Ruukki, Acelormittal, Thyssenkrupp, US Steel Kosice SRO, Tata Steel
Refining	SARAS, Shell
Other	Bulgarian Energy Holding (BEH)

Table 1: Company financial reports surveyed – listed by EU ETS sector.

A third strand of our empirical analysis is the responses to an Agenda Consultation by the IASB in late 2011. The Agenda Consultation was a general call by the IASB for feedback on accounting issues it should prioritise (and not specific to emission allowances). All 248 response letters were downloaded from the IASB website and searched for the keywords 'emissions', 'carbon' and 'Emissions Trading Schemes' (or 'ETS' – the name of the relevant IASB project). The response letters (#53) that mentioned one or more of the keywords were further analysed to ascertain their position on emission allowances (ETS as a top or medium

⁵ This level of non-participation was disappointing for our research project and, in combination with the reasons given for non-participation, suggests that the accounting treatment of emission allowances and their impact on corporations is perceived as a sensitive and significant issue.

priority for the IASB; ETS as a low priority; ETS as a non-priority/removal), and the reasons given for their position.

Accounting for carbon in the EU ETS

The short history of EU ETS financial accounting standard setting has been turbulent (see Bebbington and Larrinaga-Gonzalez, 2008; Cook, 2009; MacKenzie, 2009a). In the run up to the advent of the EU ETS in 2005, accounting guidance was issued by the IASB via its International Financial Reporting Interpretations Committee (IFRIC) with *IFRIC Interpretation 3: Emission Rights* (hereafter referred to as ‘IFRIC 3’) published shortly before the start of the EU ETS in December 2004. IFRIC 3 made a number of recommendations that created a controversy, and which led to its eventual withdrawal. There was negative reaction from EU ETS participants, especially by utilities and large industry emitters (Cook, 2009), and the European Financial Reporting Advisory Group (EFRAG) issued a particularly negative endorsement advice, which carried considerable weight because IFRIC 3 was specifically issued to deal with the accounting issues arising within Europe, because of the commencement of the EU ETS in January 2005 (Bebbington and Larrinaga-Gonzalez 2008). The main objections included the IFRIC 3 recommendation to report the gains and losses derived from the valuation of emission allowance liabilities in the income statement, while the gains and losses derived from any revaluation of the emission allowances were recognised as equity in the balance sheet (this is known as a ‘mixed presentation model’). Additionally, the nature of different assets, some measured on recognition at cost and others at fair value (known as a ‘mixed measurement model’), also caused concerns (Bebbington and Larrinaga-Gonzalez 2008; Cook 2009; MacKenzie 2009). These accounting mismatches led EFRAG to assert that the IFRIC 3 recommendations would bring about artificial volatility in company results (considering that at the time only a small amount of the total emissions

rights contained within the EU ETS were actually purchased). Given the negative endorsement advice from EFRAG, and also the views of the European Commission, the IASB withdrew IFRIC 3 in June 2005.

As a result, since 2005 there has been no international guidance on how to account for emissions allowances, and a diversity of practices has emerged (Cook, 2009; Fornaro et al., 2009; Lovell et al., 2010). An attempt was made to rectify the situation in 2008 when the IASB and the US Financial Accounting Standards Board jointly established an *Emissions Trading Schemes* project with the aim of resolving accounting ambiguity through issuing clear guidance (IASB, 2010). The remit of the *Emissions Trading Schemes* project was not just the EU ETS but any existing or proposed Emissions Trading Schemes worldwide, anticipating that there would be a growth of emissions trading internationally. Originally scheduled to publish an Exposure Draft (an accounting term, essentially draft guidelines published to elicit feedback) in late 2009 and then in late 2010, the project has now been further delayed and since late 2010 has been officially ‘paused’. It may be restarted in 2013 but this depends in part on the outcome of the wider IASB Agenda Consultation.

Key findings

One of the main findings from our analysis of EU ETS company reports was the widespread extent of non-disclosure of emission allowances (Lovell et al., 2010). In this paper we explore this finding in more detail to consider possible rationales for, and a fuller exploration of, the non-disclosure. In addition, the likelihood of the development of future accounting standards (as one remedy for non-disclosure) is considered via analysis of the 2011 IASB Agenda Consultation response letters.

Table 2 summarises the main findings of the financial report survey with regard to disclosure (ie the information actually provided by companies about their emission allowances). Much of the detail in Table 2 is somewhat impenetrable to a non-accounting audience, but findings clear to all are, first, the high level of non-disclosure (ranging from 23% to 77%) and, second, the diversity of accounting practices being used across all accounting categories. Here, as stated, we concentrate our gaze on the first of these findings – non-disclosure.⁶

The interpretation of the results about non-disclosure shown in Table 2 requires some discussion about the relevance of this information. In economic and financial accounting terms, an ‘information item’ is deemed to be ‘value relevant’ (and hence needs to be disclosed) if it is influential in shaping the economic decisions about a company by users of financial reports (investors, pension funds, shareholders and so on). The value relevance of accounting information is affected singularly by its materiality, an accounting term used to denote that the omission of this information would impair the ability of users to make a sound judgment about the company. In the case of the EU ETS, therefore, non-disclosure would be an issue if emission allowances were judged to be material to the company, either internally or externally by users of accounts (who might wish to have information on the amounts and value of emission allowances held by a company, and the emission obligations arising from corporate operations). Alternatively, if allowances and liabilities arising from the EU ETS are not material, then companies are right in not providing such disclosures in their financial statements (otherwise, the company would incur so-called ‘elaboration costs’, and the user ‘interpretation costs’ for a piece of information that has no value). Because materiality is key to judging whether or not the high level of non-disclosure for emission allowances is a problem, we undertook analysis to clarify the financial value of EU ETS allowances to a

⁶ Please refer to Lovell et al 2010 for detailed analysis of the accounting practices of large EU ETS companies, which, due to space constraints, we do not report on in detail here.

subset (#8) of the companies we surveyed that clearly reported the cost of emission allowances needed to match their emissions (see Table 3).

Accounting issue	Different accounting approaches used and percentage of companies adopting them
Granted allowances – initial recognition	Intangible assets (42%); inventory (8%); other accounting treatment (23%); no disclosure (27%)
Purchased allowances – initial recognition	Intangible assets (42%); inventory (12%); activity-based model (11%); other (8%); no disclosure (27%)
Allowances recognition in income statement	Disclosure (31%); no disclosure (69%)
Certified Emission Reductions - initial recognition	Intangible assets (4%); inventory (8%); other accounting treatment (11%); no disclosure (77%)
Granted allowances – measurement on initial recognition	Nil value/cost (62%); fair value (15%); no disclosure (23%)
Amortization/Depreciation of emission allowances	Yes (12%); no (19%); no disclosure (69%)
Re-valuation of emission allowances	Taken to the income statement (42%); taken to reserves (4%); other accounting treatment (4%); no disclosure (50%)
Measurement of liabilities	Cost with balance at market value (73%); fair value for the entire obligation (4%); no disclosure (23%)

Table 2: Key findings of EU ETS top emitters' financial report survey

Table 3 provides information on the materiality of emission allowances using a profit-before-tax method (comparing the cost of emission allowances needed to match emissions with the profit before tax, as reported in the financial reports of the eight companies surveyed). The materiality of emission allowances is revealed as high: ranging from 14% of profit/loss before tax, up to a staggering 85%. This is an important finding because it means that the high levels of emission allowance non-disclosure that we found in our survey cannot simply be explained on the grounds of non-materiality. Indeed, the analysis provided in Table 3 suggests that, even for companies valuing their granted allowances at nil (a common practice, adopted by 62% of companies we surveyed, see Table 2), these companies might need to buy enough allowances in the market to make emission allowances material to them as well.

<i>Company name</i>	<i>Consumption of emissions allowances (million Euros)</i>	<i>Profit/Loss before tax (Million Euros)</i>	<i>Consumption as a percentage of profit/Loss before tax</i>
EDP	354	1,505	23.55%
ENDESA	675	4,308	15.67%
IBERDROLA	547	3,864	14.15%
U.S. Steel Košice s.r.o.	138	383	35.96%
Eesti Energia	9	57	15.79%
Edson	162	730	22.19%
PCC	110	-396	27.73%
Saras	77	91	85.29%

Table 3: Materiality of EU ETS allowances: consumption of allowances as percentage of profit before tax (2008)

However, although this sounds like a clear case of unwarranted non-disclosure, the ambiguity of the accounting term ‘materiality’ needs yet further explanation, as there is considerable discretion (and therefore complexity) in how it is defined and applied, which explains to some extent why EU ETS non-disclosure has gone on for so long unremarked. Materiality is often defined precisely (in quantitative terms) as a threshold or cut-off point, e.g. a percentage of an appropriate benchmark (such as the profit-before-tax method we used in Table 3), in order to judge the size over which an omission would be material. The International Federation of Accountants (IFAC, 2010), for example, suggests that auditors may consider five percent of profit-before-tax to be an appropriate threshold for profit-based organizations, therefore making emission allowances material for all the companies analysed in Table 3. However, there is a degree of choice regarding the selection of the benchmark and the threshold percentage. Our analysis in Table 3 used the profit-before-tax method: the annual value of allowances needed to offset the annual emissions as a percentage of revenue or profit-before-tax. This was used in preference over an assets-based method (a more typical approach for an ‘asset’ such as an emission allowance) because, for emission allowances,

materiality cannot easily be judged as a percentage of total assets because a substantial part of the assets of large emitters (e.g. electricity companies) have a life-cycle that spans decades. Emission allowance assets (as defined within the EU ETS) have a lifecycle of only one year (because companies have to surrender allowances to the European Commission every year, even though in reality in the atmosphere the greenhouse gases remain for decades, if not hundreds of years⁷).

To complicate the issue of materiality still further, there is a qualitative aspect to defining materiality, as well as the quantitative method described above. Standards setters (IFAC, 2010) suggest –and empirical research corroborates (Chewning et al., 1989) – that materiality is not only judged in terms of the size but also in terms of the *nature* of the disclosure item. In this regard, accounting professionals may consider as material issues of a smaller financial value, provided that they are likely to influence the decisions of users of this information in cases such as “key disclosures in relation to the industry in which the entity operates” (IFAC, 2010: 320). This qualitative definition of materiality could well be applicable to large EU ETS emitters, as investors are likely to be interested in evaluating the risk arising from the future evolution of carbon markets, and climate change more generally. Thus from a broader stakeholder perspective, which goes beyond the narrow consideration of investor needs only, financial accounting currently appears on both counts (quantitative and qualitative definitions of materiality) to be underestimating the wider relevance of emission allowances. This materiality finding is corroborated by our interviews with accountants at large EU ETS emitters, as one interviewee describes in answer to a question about the future importance of emission allowance accounting:

⁷ In this regard, it could be argued that the EU ETS artificially distorts the true (scientific) atmospheric lifetime of greenhouse gases (which in international climate policy is normalised against carbon dioxide at 100 years IPCC, 2007 *Climate Change 2007: The Physical Science Basis - Summary for Policymakers* Intergovernmental Panel on Climate Change (IPCC), Paris).

“For our company it will be very important because, as it can be seen in our financial statements, we deal with a lot of [emission] allowances. So, for instance, if we... account for these allowances obtained from the government... as intangible assets and amortized them in Profit & Loss, we are sure that our Profit and Loss account, on the operational level, would be lower by about... 700 million euros....*It is very material.*”

(Interview, Deputy Head of Accounting at a large energy utility, May 2010).

So how, one might ask, has this situation of material non-disclosure amongst large EU ETS companies been able to endure for several years (since the inception of the EU ETS in 2005)? One explanation is that there simply has not been significant pressure to change. There is no obvious ‘centre of calculation’ for carbon financial accounting to propose, co-ordinate and manage change: the IASB has responsibility for financial accounting standard-setting, but, as mentioned, has not been party to the detailed operation and policy deliberations on the EU ETS. Likewise carbon market decision-makers at the European Commission and elsewhere (national governments, trade organisations) are not familiar with the technical accounting debates and do not interact much, if at all, with financial accounting standard setters. Further, a ‘bottom up’ push for change from companies active in the EU ETS has not been forthcoming because, in the absence of direct financial accounting guidance from the IASB, they are, with guidance from their auditors, free to choose their accounting practices. An interviewee describes the process they have been through at his company of gradually reducing emission allowance disclosure:

“At first we wanted to be very transparent, we wanted to disclose everything, yes?... But because we started to have a lot of problems with our auditors we decreased the disclosure...

we haven't changed the accounting scheme, which could have material impact on numbers, but we changed the disclosure... we decreased the disclosure very, very much and now it is, you know, it's good."

(Interview, Deputy Head of Accounting at a large energy utility, May 2010).

The results from a recent consultation exercise undertaken by the IASB – the 2011 Agenda Consultation – do indicate some level of support (12% of responses) for the IASB to restart its Emissions Trading Schemes (ETS) project, and issue guidance on emission allowance accounting.

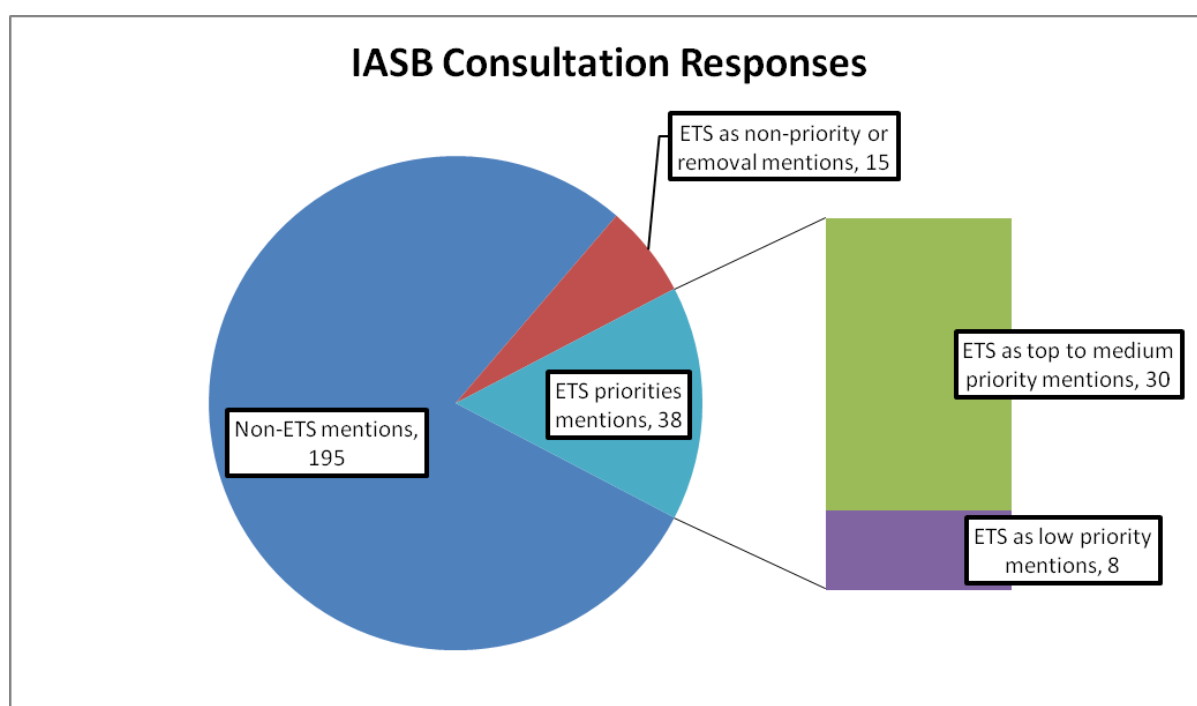


Figure 1: IASB Consultation Responses showing the number of respondents mentioning emissions trading schemes (ETS), and their suggestions for IASB action.⁸

⁸ All 248 responses to the IASB public Agenda Consultation (launched 26 July 2011 and closed 30 Nov 2011) were read and responses were flagged that contained the keywords 'Emissions', 'Emissions Trading Schemes', and 'carbon', and compiled them into a dataset. Through the Agenda Consultation the IASB sought input from all interested parties on the strategic direction and the broad overall balance of its work plan – there were no specific questions in the consultation document about the EU ETS or emissions trading.

As Figure 1 illustrates, 53 out of the total 248 response letters to the IASB public consultation mentioned, unprompted, “*emissions*”, “*ETS*” or “*carbon*”, equating to 21.4% of all responses, a significant number. Of these ETS responses, 30 (12% of total responses) suggested the IASB Emissions Trading Scheme project is a top or medium priority, 8 (3%) as a low priority, and 15 (6%) asked for its removal (or ‘non-priority’). A selection of reasons given for prioritisation/non-prioritisation (Table 4) illustrates the relatively strong support for the IASB to take action in this area.

Type of Response	Illustrative Examples of Reasons given
<i>ETS as top or medium priority</i>	<ul style="list-style-type: none"> Narrowed/targeted focus or specifically on free of charge allowances in ETS should suffice Due to various jurisdictions and number of entities affected, there are risks due to divergent accounting practices, leading to lack of comparability for investors In the long term, ETS accounting should be included under the rules for “intangible asset” accounting Prioritisation for ETS accounting is a good time to prepare for phase 3 of EU ETS
<i>ETS as low priority</i>	<ul style="list-style-type: none"> There are more important projects such as core work of IASB, and ETS accounting is too narrow ETS accounting lie within wider scope of issue of defining “intangible assets” and that should be pursued first, with ETS accounting to follow on
<i>ETS as non- priority or removal</i>	<ul style="list-style-type: none"> There is simply no need for ETS as priority IASB should focus firstly on conceptual framework projects, such as revenue recognition, insurance and financial instrument accounting, etc, and only after the completion of these projects, should ETS accounting be pursued Significant and sufficient work is already done, plus utilities industry has already a consistent methodology of accounting for emission allowances There is no significant impact from differences of accounting treatments of emission allowances

Table 4: Analysis of letters received in response to the IASB 2011 Agenda Consultation that mention Emissions Trading Schemes (ETS)

Our interviews with accountants appear to back up this tentative support for the IASB restarting its Emission Trading Schemes (ETS) project.

“We keep books here under three different accounting standards.... Under each of these reporting standards we record our emission transactions in a completely different way. So anything that joins these treatments or eliminates differences will help us a lot because this is so different and causes such differences between one set of books and another set of books... it is every single transaction that is calculated in a different way, so it is very complex.”

(Interview, Director of Accounting Compliance, EU ETS steel company, April 2010).

And in relation to disclosure (or lack of it) the IASB is seen as the organisation who has the power to effect change:

“It is only when it is demanded by the accounting principles or by the IFRS standard, then yes, they have to disclose it. But when it is not demanded then nobody will disclose it by itself.”

(Interview, Head of Finance at a large European energy company, April 2010).

In summary, our empirical analysis of non-disclosure of emission allowances in the accounts of large European greenhouse gas emitters has clarified that emission allowances are material, and hence disclosure should be taking place. The prolonged absence of a financial accounting standard for emission allowances is the reason why non-disclosure is high, and the 2011 IASB Agenda Consultation suggests that there is some support for a carbon financial accounting standard to be developed.

Conclusions

In conclusion we briefly summarise our key findings and make recommendations for the development of policy and theory, returning to our three core questions raised at the start of the paper. First, in relation to our question about the financial accounting and reporting practices being used in Europe, our main finding is that there are high levels of non-disclosure. This is important (in answer to our second question) because it suggests that market organisations worryingly have no basis on which to form views about individual companies within the EU ETS, and the impact of the EU ETS on their financial positions. Moreover, the valuation of most emission allowance assets and liabilities at zero (see ‘Granted Allowances’, Table 2) provides no information on the risks that might be faced by companies should they have to pay for allowances (something that is going to be experienced for most companies in 2013). Taken together, these findings provide evidence of a significant lack of key data on activities that are likely to be ‘value relevant’ to investors and other financial market organisations. This is an important anomaly within the EU ETS, a market mechanism designed, after all, to make corporate pollution visible. It is evident that the ‘calculative frame’ for carbon financial accounting has yet to be stabilized. Indeed, with a shift to auctioning allowances in Phase 3 of the EU ETS (from 2013) the calculative frame is set to alter, and there are likely to be knock on accounting implications, not least that companies will no longer be able to account for assets and liabilities at nil value (because allowances will no longer be given out for free). Although auctioning will alleviate the accounting problem of the initial valuation of allowances, there is likely to be scope for differences between the price at auctioning and fair value because of market volatility in the price of emission allowances.

Large corporate emitters in the EU ETS, auditors, governments, accounting standard setters, academics, and other organizations (carbon accounting charities, specialist industry groups) all have the possibility of effecting change in how accounting for emission allowances is done, but timing is crucial - it is the next few years that will be most important because of the shift to auctioning of allowances in 2013, the inclusion of new industry sectors in the EU ETS (notably aviation), and the possible issuance of IASB-FASB guidance in this area. A level playing field for accounting treatment and disclosure is required to allow fair and transparent comparison of EU ETS financial statements. A key reason for the inaction to date is the lack of dialogue about carbon financial accounting, this can be explained as partly to do with issues of commercial confidentiality, but also more prosaically as simply about the relevant institutions (the IASB and EU ETS branch of the European Commission in particular) not having a history of working together; put simply their paths rarely cross. One policy recommendation is to have a series of workshops, potentially based around the notion of developing a voluntary carbon financial accounting standards, in order to forge common ground and create further opportunities for dialogue.

The existence of high non-disclosure also raises theoretical questions about the ability of carbon financial accounting to influence EU ETS policy and carbon markets more generally. In relation to our third core question for the paper regarding the insights from theory, accounting and society research has demonstrated the role of accounting in influencing corporate and wider social processes. But to date the impact of EU ETS financial accounting has been to obscure the financial effect of carbon markets on large European companies. In so doing, financial accounting is limiting the effectiveness of the EU ETS, meaning that decisions, for example, about investment in low-carbon technologies, are not fully

considering the cost of emissions and are therefore in practice not operating in a manner consistent with the objectives of the EU ETS.

Hence, crucially, the ambiguity over the materiality of emission allowances to large corporations in Europe is less about the significance of climate change per se to these corporations, and more to do with the particular systems of measurement and classification for climate change mitigation that have emerged through international climate change policy and the EU ETS; policies and market mechanisms which ultimately simplify and frame emission allowances within an annual corporate accounting cycle. It seems paradoxical that a policy instrument – the EU ETS - that is officially stated as having “forced the cost of emissions onto the agenda of company boards” (European Commission, 2008: 5) be in practice treated as non-material in the financial statements of the main companies affected.

In this paper we have demonstrated that far from being rule-based and standardised – a ‘neutral device’ – carbon financial accounting at present remains highly volatile and contested. This makes the study of accounting for emission allowances an interesting case study into the nature of accounting, as well as for the operation of carbon markets. It is evident that a great deal of work goes into sustaining carbon markets, and determining financial accounting rules and their implementation is an important element of this activity.

The study of the particular issues that emerge in accounting for emission allowances demonstrates ambiguity and uncertainty about its outcome and as such can help us to understand accounting principles and practices in the making. Following ideas from theories of measurement and calculation, one might have expected a lack of international accounting standards to make carbon financial accounting practices more visible and a topic of frequent

policy debate. That this has not occurred – debate has been mostly restricted to specialist financial accounting forums, such as the IASB – can be explained at least in part by the highly technical nature of carbon financial accounting, with Barry's (2005) ideas of technology as anti-political having strong resonance.

We have demonstrated how emission allowances are hard to classify - they are a type of 'incommensurable' - and accounting practitioners in the EU ETS are trying to deal as best they can with this ambiguity. Others have convincingly argued that carbon market design is all about 'making things the same', but here we reveal the inevitable tensions in this ambitious harmonizing objective, showing how in practice the multiple potential uses of allowances (as a commodity, a currency and a financial instrument) pose a problem for accountants: for it is accountants who must do the difficult work of stabilizing these multiple identities within corporate financial reports, and most companies are therefore presently choosing not to disclose. Ideas about hybrid markets highlight the central importance of coming to a decision on standardising emission allowance accounting, in order to allow market relations to stabilize. Recognising that carbon markets have been created by governments and other institutions opens up the possibilities for changing how they work, including their financial accounting 'bedrock'. Through their struggle to define and manage emission allowances, with multiple framings of calculation still in play, EU ETS accountants are playing a crucial but largely unnoticed role in influencing how (and perhaps indeed whether) the problem of climate change can be made sense of and governed through markets.

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Bibliography

Alonso W, Starr P, 1984 *The Politics of Numbers: the Population of the United States in the 1980s* (Russell Sage Foundation, New York)

Ascuí F, Lovell H, 2011, "As frames collide: making sense of carbon accounting" *Accounting, Auditing and Accountability Journal*. **24** forthcoming

Bailey I, Wilson G A, 2009, "Theorising transitional pathways in response to climate change: technocentrism, ecocentrism and the carbon economy" *Environment and Planning A* **41** 2324 - 2341

Bank of England, 2009 *Issue 116 - Emission Allowances: creating legal certainty* Financial Markets Law Committee, London

Barry A, 2005, "The anti-political economy", in *The Technological Economy* Eds A Barry, D Slater (Routledge, London and New York) pp 84-100

Bebbington J, Barter N, 2011 *Strategic Responses to Global Climate Change: A UK analysis* Chartered Institute of Management Accountants, London

Bebbington J, Larrinaga-Gonzalez C, 2008, "Carbon Trading: Accounting and Reporting Issues" *European Accounting Review* **17** 697-717

Bowker G C, Star S L, 2000 *Sorting things out: classification and its consequences* (The MIT Press, Cambridge, Mass)

Boyd E, Boykoff M, Newell P, 2011, "The 'New' Carbon Economy: What's New?" *Antipode* **43** 601-611

Bridge G, 2010, "Resource Geographies I: Making carbon economies, old and new" *Progress in Human Geography* **November 5th 2010** 1-15

Bumpus A, Liverman D, 2008, "Accumulation by decarbonisation and the governance of carbon offsets" *Economic Geography* **84** 127-156

Burchell S, Clubb C, Hopwood A, 1985, "Accounting in its Social Context: Towards a History of Value Added in The United Kingdom" *Accounting, Organizations and Society* **10** 381-413

Burchell S, Clubb C, Hopwood A, Hughes J, Nahapiet J, 1980, "The roles of accounting in organisations and society" *Accounting, Organisations and Society* **5** 5-27

Busch L, 2000, "The moral economy of grades and standards" *Journal of Rural Studies* **16** 273-283

Callon M, 1998 *The Laws of the Markets* (Blackwell Publishers/The Sociological Review, Oxford)

Callon M, 2007, "What does it mean to say that economics is performative?", in *Do economists make markets? On the performativity of economics* Eds D MacKenzie, F Muniesa, L Siu (Princeton University Press, Princeton) pp 311-357

Callon M, 2008, "Civilizing markets: carbon trading between *in vitro* and *in vivo* experiments" *Accounting, Organizations and Society* **34** 535-548

Callon M, Millo Y, Muniesa F, 2007 *Market Devices* (Blackwell Publishing, Oxford)

Chewning G, Pany K, Wheeler S, 1989, "Auditor Reporting Decisions Involving Accounting Principle Changes: Some Evidence on Materiality Thresholds." *Journal of Accounting Research* **27** 78-96

Cook A, 2009, "Emission rights: from costless activity to market operations" *Accounting, Organizations and Society* **34** 456-468

Dean M, 1999 *Governmentality: power and rule in modern society* (Sage Publications, London)

Espeland W N, Stevens M L, 1998, "Commensuration as a social process" *Annual Review of Sociology* **24** 313-143

European Commission, 2008 *EU action against climate change. The EU Emission Trading Scheme*. Office for Official Publications of the European Communities, Luxembourg

Fligstein N, 1996, "Markets as Politics: A Political-Cultural Approach to Market Institutions." *American Sociological Review* **61** 656-673

Fornaro J, Winkelman K, Glodstein D, 2009, "Accounting for Emission: emerging issues and the need for global accounting standards" *Journal of Accountancy* **208** 40-47

Foucault M, 1991, "Governmentality", in *The Foucault Effect: studies in governmentality* Eds G Burchell, C Gordon, P Miller (Harvester Wheatsheaf, London) pp 87-104

- Gouldson A, Bebbington J, 2007, "Corporations and the governance of environmental risk" *Environment and Planning C: Government and Policy* **25** 4-20
- Hardie I, Mackenzie D, 2007, "Assembling an economic actor: the *agencement* of a Hedge Fund" *The Sociological Review* **55** 57-80
- Hopwood A G, Miller P, 1994 *Accounting as Social and Institutional Practice* (Cambridge University Press, Cambridge)
- IASB, 2009, "Emissions trading schemes: accounting for the right to future installments. Agenda paper 18", International Accounting Standards Board, <http://www.iasb.org/NR/rdonlyres/575CE784-A7CF-4125-89E7-C06589C872D9/0/ETS1209b18obs.pdf>
- IASB, 2010, "Emissions Trading Schemes", International Accounting Standards Board (IASB), <http://www.ifrs.org/Current+Projects/IASB+Projects/Emission+Trading+Schemes/Emissions+Trading+Schemes.htm>
- IFAC, 2010 *International Standard on Auditing 320 "Materiality in Planning and Performing an Audit"* International Federation of Accountants (IFAC), London
- IPCC, 2007 *Climate Change 2007: The Physical Science Basis - Summary for Policymakers* Intergovernmental Panel on Climate Change (IPCC), Paris
- Linacre N, Kossoy A, Ambrossi P, 2011 *State and Trends of the Carbon Market 2011* The World Bank, Washington DC
- Lohmann L, 2009, "Toward a different debate in environmental accounting: The cases of carbon and cost-benefit" *Accounting, Organizations and Society* **34** 499-534
- Lovell H, Bulkeley H, Liverman D, 2009, "Carbon offsetting: sustaining consumption?" *Environment and Planning A* **41** 2357-2379
- Lovell H, MacKenzie D, 2011, "Accounting for Carbon: The Role of Accounting Professional Organisations in Governing Climate Change" *Antipode* **43** 704-730
- Lovell H, Sales de Aguiar T, Bebbington J, Larringa-Gonzalez C, 2010 *Accounting for Carbon - ACCA & IETA Research Report 122* The Association of Chartered Certified Accountants (ACCA) and the International Emissions Trading Association (IETA), London
- MacKenzie D, 2006, "Working Paper - Producing Accounts: finitism, technology and rule following", Edinburgh University, www.sps.ed.ac.uk/_data/asests/pdf_file/0010/3421/ProducingAccounts8Nov06.pdf
- MacKenzie D, 2007, "The material production of virtuality: innovation, cultural geography and facticity in derivatives markets" *Economy and Society* **36** 355-376
- MacKenzie D, 2008 *Material Markets: How Economic Agents are Constructed* (Oxford University Press, Oxford)

- MacKenzie D, 2009a, "Making things the same: Gases, emission rights and the politics of carbon markets" *Accounting, Organizations and Society* **34** 440-455
- MacKenzie D, 2009b, "Working Paper - The Credit Crisis as a Problem in the Sociology of Knowledge" http://www.sps.ed.ac.uk/__data/assets/pdf_file/0019/36082/CrisisNew19.pdf
- McGready M, 2008, "Accounting for Carbon" *Accountancy*, pages 84-85
- Miller P, 1994, "Accounting as social and institutional practice: an introduction", in *Accounting as social and institutional practice* Eds A G Hopwood, P Miller (Cambridge University Press, Cambridge) pp 1-39
- Miller P, O'Leary T, 1994, "Governing the calculable person", in *Accounting as social and institutional practice* Eds A G Hopwood, P Miller (Cambridge University Press, Cambridge) pp 98-115
- Mitchell T, 2008, "Rethinking economy" *Geoforum* **39** 1116-1121
- Munro M, Smith S J, 2008, "Calculated affection? Charting the complex economy of home purchase" *Housing Studies* **23** 349-367
- Polanyi K, 1944 *The Great Transformation: the political and economic origins of our time* (Beacon Press, Boston, US)
- Power M, 1999 *The Audit Society: Rituals of Verification* (Oxford University Press, Oxford)
- PricewaterhouseCoopers, International Emissions Trading Association, 2007 *Trouble-entry Accounting - Revisited* PriceWaterhouse Coopers (Pwc) and the International Emissions Trading Association (IETA), London
- Pryke M, 2007, "Geomoney: an option of frost, going long on clouds" *Geoforum* **38** 576-588
- Robson K, 1992, "Accounting numbers as 'inscription': action at a distance and the development of accounting" *Accounting, Organizations and Society* **17** 685-708
- Spence L J, Rinaldi L, 2012, "Governmentality in accounting and accountability: A case study of embedding sustainability in a supply chain" *Accounting, Organisations and Society* **in press**
- The Aldersgate Group, 2007 *Carbon Costs: Corporate Carbon Accounting and Reporting* The Aldersgate Group, London
- Thompson G, 1994, "Early double-entry bookkeeping and the rhetoric of accounting calculation", in *Accounting as social and institutional practice* Eds A G Hopwood, P Miller (Cambridge University Press, Cambridge) pp 40-66
- Timmermans S, Epstein S, 2010, "A World of Standards but not a Standard World: Toward a Sociology of Standards and Standardization" *Annual Review of Sociology* **36** 69-89
- White H C, 1981, "Where Do Markets Come From?" *American Journal of Sociology* **87** 517-547